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Contribution from the Bureau of Plant Industry, Wm. A. Taylor, Chief.

MUSCADINE GRAPE SIRUP.[1]

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CONTENTS.

INTRODUCTION.

The Muscadine grape[2] is a native of the southeastern United States, where the vines grow wild in the woods and produce fruit abundantly. Here and there throughout this territory, selected choice varieties are grown in vineyards ranging from a quarter of an acre to as many as 200 acres. Many farm homes in the South are provided with Muscadine grape arbors similar to the one shown in figure 1. The supply of these grapes is so plentiful on many southern farms that a considerable quantity is wasted each year. This is especially true where the farm is located at some distance from a good local market or shipping point.

This bulletin suggests how a portion of this surplus may be profitably utilized, as it has been demonstrated that a good sirup can be made from Muscadine grapes in the farm home.

[1] The Muscadine grape-sirup investigations are the result of preliminary laboratory tests made in a small way by the Fruit and Vegetable Utilization Laboratory of the Bureau of Chemistry. In making these sirups the methods used follow closely those recommended in the Yearbook of the Department of Agriculture for 1914 (Separate 639), for making apple sirup.

The writer wishes to acknowledge indebtedness to his associate, Mr. Elmer Snyder, for assistance in the field, and to Mr. and Mrs. John H. Jefferies, of Willard, N. C., for the use of their kitchen and for other favors.

[2] Farmers' Bulletin 709, entitled "Muscadine Grapes," may be had free of charge as long as the supply lasts on application to the United States Department of Agriculture.

The Muscadine grape sirup made in accordance with the directions given on a subsequent page was found to have a delicate and unique fruity flavor. It can be used like other table sirups and is excellent with pancakes, waffles, or bread and butter. Children especially seem to like it. Its value as a flavoring adjunct or in cooking and candy making has not been tested, but, produced in the farm home, it can be made to supplement, or even replace, products requiring a considerable cash outlay.

During the fruiting season of 1915, 30 different lots of sirup were made from the Muscadine grapes grown at the cooperative experiment vineyard of the United States Department of Agriculture on the State test farm at Willard, N. C. All the utensils used in connection with the making of the sirups were purchased from merchants

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FIG. 1.—A typical Muscadine grape arbor, such as may be found on many farms in the Muscadine grape territory. These arbors support one to several vines and sometimes cover a quarter of an acre of ground.

in a small near-by town. Wood cut on the farm was used as fuel and at the same time furnished the heat necessary for other kitchen operations. The sirup was made in the kitchen of the State test farm simultaneously with the regular kitchen work, so that the results are entirely practical. It was demonstrated that this sirup can be made in the farm home with little effort and by the use of such utensils as are found in every kitchen. The only necessary cash outlays where there is a surplus of fruit will be for (1) picking, crushing, and pressing the grapes; (2) fruit jars in which to store the finished product; and (3) a small quantity of carbonate of lime.

The unbiased opinions of many individuals in regard to the value of the experimental sirups have been obtained. These include farmers who have made sorghum sirup, farm laborers, ladies with ordinary experience, children, several individuals known to have decided

natural tastes for sorghum or maple sirup, specialists in sirup making and home economics, and others whose opinions were considered worth while. The unanimous opinion of nearly 100 people who tested the samples of Muscadine grape sirups made in the autumn of 1915 is that they are good; many pronounced them excellent. The best grades of sirup were estimated to be worth approximately 85 cents per gallon in comparison with sorghum sirup at 50 cents per gallon. All but two of the Muscadine grape sirups were considered equal or superior to sorghum sirup. Two of those who tried the sirups, however, pronounced themselves prejudiced in favor of sorghum sirup, ranking it higher than any of the grape sirups. Of the two samples rated below sorghum sirup, one had been scorched in cooking and the other was made from grapes of very inferior quality. The sorghum sirup used for comparison was of a make having an established reputation and was pronounced of the highest quality by the two persons who preferred sorghum sirup.

The method used in making Muscadine grape sirup is very simple, and with proper care an inexperienced operator can succeed.

VARIETIES.

The quality of the sirup made from different varieties of Muscadine grapes varies considerably. The varieties having the highest natural sugar and lowest natural acid content usually make the most delicious and highest quality sirup and also yield the most sirup per gallon of fresh juice. The Scuppernong, Thomas, Luola, Latham, Mish, George, and similar varieties of high quality make the best sirups. The James makes a sirup of fair quality, while the Flowers and Eden varieties make sirups which, relatively speaking, would be called acid and rough.

PICKING.

In picking grapes for sirup it is important to select only sound, ripe fruit. Green grapes greatly increase the acidity and reduce the quality of the finished product. Rotted or spoiled grapes impart a bitter, disagreeable taste and an unpleasant odor to the sirup.

CRUSHING.

In making sirup an ordinary cider mill may be used for crushing and pressing the fruit, but if only a small quantity of grapes is to be taken care of they may be crushed with the hands or with a wooden maul or wire potato masher. Figure 2 illustrates the inexpensive homemade outfit used in conducting these experiments. The crusher of this outfit (fig. 2, *I*) consists merely of a hopper attached to two skids of sufficient length and size to enable the crusher to rest on top of the press, as shown in figure 4, and a solid corrugated wooden cyl-

inder located in the bottom of the hopper. When the cylinder, which is fitted with a handle and studded with small nails, is revolved, the grapes in the hopper are pulled downward between the cylinder and the side of the hopper and there crushed sufficiently to liberate the pulps from the skins. The wooden cylinder was made from a rolling-pin gouged to make parallel grooves one-half inch wide, three-fourths inch deep, and from one-fourth to one-half inch apart, running the entire length of the cylinder. It is studded with small nails about three-fourths of an inch apart, which protrude about one-fourth to one-half inch. There is a space of one-half to three-fourths of an inch between the cylinder and the inside of the hopper.

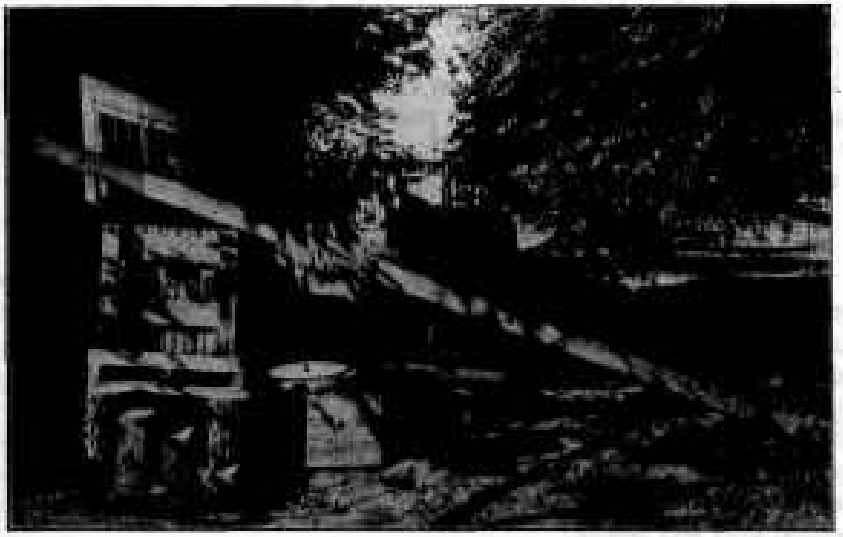

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FIG. 2.—A homemade grape crusher and press used in the Muscadine grape-sirup experiments, showing its construction: *A*, Stationary part of the press; *B*, press blocks; *C*, false bottom; *D*, top, lower surface; *E*, pan to receive the juice as it flows from the press; *F*, pomace bag which holds the crushed grapes while they are being pressed; *G*, lever hinged to the building; *H*, weight to be attached to the outer end of the lever; *I*, grape crusher.

Figure 3 illustrates a grape crusher having two cylinders. A crusher of this type requires more mechanical skill in its construction, but is more effective.

PRESSING.

In the absence of a cider press, any grower who is mechanically inclined will have no trouble in making a press at slight cost. Figure 2 shows the various parts of the homemade press used in the Muscadine grape-sirup experiments, so arranged as to illustrate their construction. A forward-sloping floor with elevated sides was placed on a firm foundation. A spouted opening at the front allowed the grape juice to flow out into a container. The square basket or frame

(fig. 2, *A*) erected on this floor had slatted sides. A slatted false bottom (fig. 2, *C*) was made to rest on the floor of the press inside this frame. A bag, such as is used in shipping bran (fig. 2, *F*), was suspended inside the basket, into which the crushed grapes fell. A solid block top (fig. 2, *D*), just small enough to slide easily up and down inside the frame, was placed on top of the bag of grapes. Pressure was exerted by a lever (fig. 2, *G*), and transmitted to the top of the press by means of press blocks (fig. 2, *B*, and fig. 5). The lever was made by hinging one end of a 2 by 6 inch piece of lumber, 14 to 16 feet long, to a post or building just back of the press. A weight of about 150 pounds was attached at the outer end of the beam. A rope fastened to the outer end of the lever and to trees on either side served to prevent the lever from swinging sideways; but two guide posts, erected one on either side of the lever, would serve this purpose better, as they would allow the lever more freedom in moving up and down.

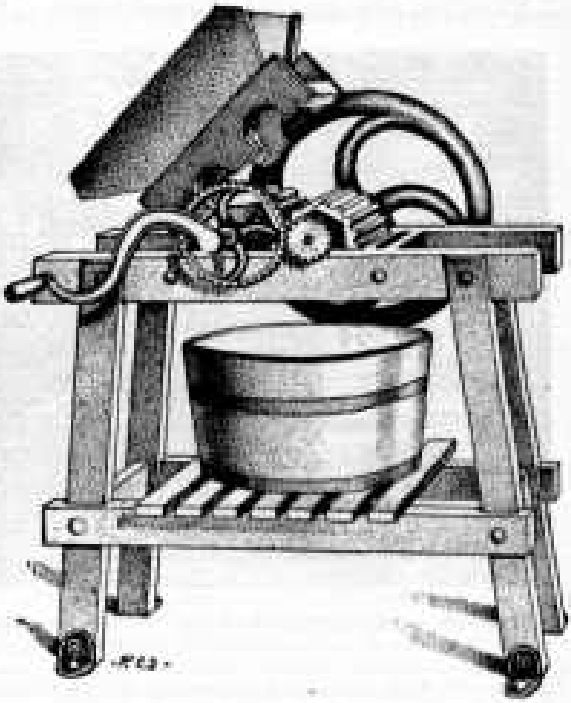

FIG. 3.—A commercially manufactured 2-cylinder crusher.

Figure 4 shows the press at a time when grapes were being crushed into it, and figure 5 shows the press while the juice was being expressed. This press was constructed from materials on the farm estimated to cost 75 cents, and a local carpenter charged 80 cents for his time, making a total cost of $1.55. Other types of farm presses could be constructed.

Before using the press for the first time, it should be scalded with hot water. This will cleanse the various parts and swell the flooring so that it will not leak. As soon as each pressing is completed, it is important to remove all pomace from the press and to wash with clean water all the parts that have come in contact with the juice. This will prevent fermentation and souring at the press and the giving of foreign flavors to later lots of juice.

The grapes should be cold pressed as soon as crushed. The free-run or first juice that comes from the press is more desirable for sirup making than that which is secured under pressure. This is principally due to the fact that the free-run juice is higher in sugar content and lower in acid content than the pressed juice. When pressure is applied, the juice flows freely at first and then at a gradually slower and slower rate for many hours, but it is not desirable to allow a batch of pomace to stand in the press longer than five or six hours. Usually it will be found most desirable to press during the day, cook the juice the first time in the late afternoon or evening, allow it to stand in the precipitating jars over night, and boil it down to a sirup

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FIG. 4.—The press set up with the crusher in place. The false bottom has been dropped into the body frame, and the pomace bag has been put in place, the top of the bag being stretched back over the two middle slats of the frame so that it remains open to receive the crushed grapes. The skids of the crusher rest on the sides of the frame, holding the pomace bag in place. The lever is resting on the top of the crusher and holds it steady while the grapes are being crushed. The crushed grapes fall directly from the crusher into the pomace bag. (Compare with figure 2.)

the next morning. Generally speaking, a bushel of grapes will yield, when cold pressed, from 2½ to 4 gallons of fresh juice, depending upon the variety. Most varieties yield at least 3 gallons. On this basis, condensing the juice to one-ninth of its volume, which has been found to give a sirup of satisfactory consistency, 1 bushel of grapes, cold pressed, should yield 1⅓ quarts of sirup. Heated grapes yield more juice than cold-pressed grapes but make a sirup of inferior quality.

The labor cost for crushing and pressing the grapes, even when only a small quantity is handled, is very small if equipment similar to that illustrated in this publication is used. It is estimated that not more than 20 minutes will be required to crush and press a single bushel of grapes and to do the necessary cleaning up.

MAKING THE SIRUP.

To remove any sediment that may have accumulated while the grapes were being crushed and pressed, the juice should be strained through a double thickness of cheesecloth. For every 6 quarts of fresh, strained Muscadine grape juice, stir in 1 ounce of powdered calcium carbonate (carbonate of lime, a low-priced chemical used in sirup making to remove acids). Heat the juice and allow it to boil for about 8 minutes. It is necessary to use a container at least one-third larger than the volume of juice, in order to prevent overflowing the vessel when the juice foams up and breaks into a boil. Where a large vessel is not available the juice may be boiled in small quan-

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FIG. 5.—The homemade grape press in operation. The crusher has been removed, the pomace bag folded in, the top placed on the bag, the press blocks put in place, the lever rested on them, and the weight suspended from the outer end of the lever. (Compare with figure 2.)

tities. Pour the hot liquid into tall glass containers, preferably large-mouthed fruit jars, so as to permit its condition to be observed. Allow the liquid to settle until perfectly clear and cool. It is well to let it stand over night. After the liquid is cool and clear, showing a distinct sediment at the bottom, pour off the clear portion into a cooking vessel, being careful not to pour off any of the sediment. To this clear liquid add one-sixth of a level teaspoonful of calcium carbonate for each 6 quarts of fresh grape juice which it represents.

Complete the process of sirup making by boiling down the clear liquid, using a vessel one-third larger than the volume of the liquid. If necessary, the sirup can be completed in batches. While boiling down the liquid, keep the caramel forming on the inside of the pan wiped off with a wet cloth, so that when the nearly finished product

foams up it will not carry scorched caramel into the sirup. Should any scum form during the cooking process, it should be removed with a long-handled milk skimmer. Allow the liquid to boil rapidly until nearly done and then more slowly, to avoid scorching. Cook the liquid until it reaches about one-ninth the volume of the fresh grape juice, or until a small portion cooled in a teaspoon on the surface of cold water in a cup shows about the same consistency as maple sirup or thin sorghum sirup.

When the sirup has reached the proper thickness, pour it off into glass fruit jars, cap the jars, and place them where they will cool very slowly. Slow cooling is very important in making the sirup clear, as it allows all sediment and added substances to settle completely. This slow cooling can be brought about by standing the

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FIG. 6.—Kitchen equipment used in making 2 pints of sirup from 9 quarts of Muscadine grape juice.

jars of sirup in a large vessel of hot water and allowing the whole to cool, or, better still, by placing the jars in homemade fireless cookers, such as are shown in figure 6 at *A*. These are made by placing waste cotton, such as may be procured from a cotton gin, in worn-out buckets or boxes, leaving a place in the center for the hot sirup jars.

When the sirup has cooled to room temperature it can be stored in the pantry or cellar until desired for use. A small quantity of harmless white sediment, known to chemists as malate and tartrate of lime, will be observed in the bottom of the jars. When desired for use, simply pour the clear sirup into the table sirup stand, leaving the sediment, which is not easily disturbed, behind. Those who prefer, however, can pour off the clear sirup into bottles or fruit jars as soon as it has cooled and then sterilize and seal them while

warm, just as with fruit. Sterilization consists merely in heating the jars of sirup to the boiling point. The jars after being filled and the caps for sealing them are placed in a pan of water, which is then brought to a boil and held at that point until the contents of the jars are approximately the same temperature.

COMMENTS AND SUGGESTIONS.

Except where glassware has been recommended it is very desirable to use only granite ware utensils in handling the grape juice and in making the sirup, for such vessels are easily cleaned. A large granite ware dish pan is probably the best container to use in boiling the liquid, for it exposes a large surface to the stove and allows rapid evaporation. If preferred, however, a granite ware wash boiler, preserving kettle, or a large stewpan may be used instead of the dish pan.

Figure 6 shows the kitchen equipment used in the sirup experiments. The use to which the various utensils were put is as follows: *A*, Homemade fireless cookers in which the jars of finished sirup were placed while hot for the purpose of making the sirup cool slowly, thus allowing the sediment and added substances to settle to the bottom of the jar; *B*, a stewpan for heating the sirup jars and for cooking part of the juice the first time; *C*, dish pans, one for catching the juice at the press and for heating the precipitating jars and the other for cooking most of the juice the first time and for cooking all the juice the second time; *D*, 2-quart fruit jars (precipitating jars), containers for the juice while clarifying between the first and second cookings; *E*, a quart cup for measuring the fresh juice, in order to determine the amount of calcium carbonate to be added; *F*, a dipper for stirring the juice during the first cooking; *G*, a strainer with cheesecloth for straining the fresh grape juice; *H*, a funnel used while pouring the juice and sirup into jars; *I*, a long-handled milk skimmer for skimming the boiling sirup; *J*, a wet cloth for wiping the caramel formation from the inside of the pan while the sirup is boiling down; *K*, a bottle of calcium carbonate, the cheap chemical used in sirup making; *L*, a cup of water and a teaspoon for testing the sirup to determine when it is done; *M*, a saucer in which to weigh the calcium carbonate; and *N*, scales for weighing the calcium carbonate. The finished product is shown in two glass jars (*O*).

Calcium carbonate (carbonate of lime) is used in sirup making for the purpose of removing acids. In the presence of heat it combines chemically with the acids of the grape juice to form compounds which precipitate as sediment or crystallize against the sides of the precipitating jars when the liquid is placed in them to cool after the first boiling. This chemical can generally be obtained from a local drug store, and even if it is not in stock the druggist can order it

from a druggists' supply house. There are many natural forms of calcium carbonate of greater or less purity; for example, shells, limestone, marble, marl, and chalk. The commercial forms recommended for use in sirup making are chemically pure calcium carbonate, commercial calcium carbonate, powdered precipitated chalk, and powdered marble dust.

There is also a commercial carbonate of lime used by painters which is known as whiting. This is very cheap, costing approximately 1 cent per pound. Whiting is, however, recommended for use in sirup making only when it can be obtained in the original package in which it was put up by the manufacturer, for in a paint store an opened package is susceptible to contamination by such harmful impurities as white lead and Paris green.

A slight excess of carbonate of lime added to the grape juice in sirup making will do no harm, but generally 1 ounce to each 6 quarts of fresh grape juice will be sufficient to remove the acids. Should the grape juice be relatively high in acid content, however, it would be advisable to add from 1¼ to 1½ ounces of carbonate of lime for each 6 quarts of fresh juice before the first boiling.

When the grape juice is first heated it is well to stir it occasionally, but too much stirring seems to increase foaming. As the juice is coming to a boil a heavy foam will form on the surface, rise up, break away, and then subside. As this foam which develops previous to boiling contains free carbonate of lime it should not be skimmed off. The combining of the carbonate of lime with the grape-juice acids gives to the liquid a greenish tinge, which disappears with the precipitation of sediment after the first boiling.

In order to avoid breaking the precipitation jars and also the fruit jars when receiving the finished sirup, it is necessary to heat them to approximately the temperature of boiling water. This can be done very easily by immersing the jars in hot water.

While it is desirable to allow the liquid to boil rapidly during the cooking process, it is not advisable to remove the lids from the stove in order to have the pan next to the fire, for in this case the heat will be concentrated too much and will scorch the sirup.

It is difficult to describe the stage in the process when the sirup has been boiled down sufficiently, but the sirup maker can easily determine this after one experience. The aim should be to remove the liquid from the stove when it has reached the consistency of a thin sirup. An experienced cook can judge this rather accurately by dropping the liquid from a spoon. The best test, though, is occasionally to take a little sirup in a teaspoon and hold this on the surface of some cold water in a cup, so as to cool it. The cooled sirup in the spoon can then be felt with the finger and its thickness judged.

For keeping Muscadine grape sirup, wide-mouthed fruit jars of pint and quart sizes will be found satisfactory.

In making Muscadine grape sirup the juice of the varieties of grapes mentioned on a foregoing page as being best adapted for sirup will need no sugar; in fact, they should not have sugar added. The sirup of acid varieties like the Flowers and Eden, however, will be improved by the addition of some sugar; say, from one-half to 1 pound for each 6 quarts of juice. The experiments show that the addition of one-half pound of ordinary cane sugar to 6 quarts of Flowers grape juice is equal to the addition of 3 extra quarts of fresh juice of the same variety, in terms of the quantity of sirup produced. The time to add the sugar is just before the second cooking. In this connection attention should be called to the Federal pure-food standards, which require that when a fruit sirup to which sugar has been added is offered for sale in interstate commerce the container must bear a label stating that fact.[1]

SUMMARY.

A good table sirup can be made in the home from Muscadine grapes.

Muscadine grapes thrive in the southeastern United States, and the homes of that section are generally plentifully supplied with the fruit.

The sirup can be made from surplus fruit which is usually allowed to go to waste.

Only the inexpensive equipment illustrated and described in this bulletin is required, and the method is so simple that a person should succeed on the first attempt.

Generally speaking, the process of making the sirup consists of the following steps: (1) Harvesting the fruit and extracting the juice, (2) boiling with calcium carbonate, to reduce acidity, (3) precipitating the acidified carbonate, or clarifying the juice, (4) boiling down the cleared juice to a sirup of the desired thickness, and (5) canning or bottling the sirup.

Varieties of Muscadine grapes having a high sugar and a low acid content make the best sirup.

A bushel of Muscadine grapes will yield from 2¼ to 4 gallons of fresh juice, depending on the variety. Most varieties, especially those best suited for sirup making, yield over 3 gallons of fresh juice.

In condensing the juice to one-ninth of its original volume to make a sirup of satisfactory consistency, 1 bushel of Muscadine grapes should yield approximately 1⅓ quarts of sirup.

Muscadine grape sirup is considered by many as good as or better than other sirups usually found upon the table.

As Muscadine grape sirup is usually made from home-grown fruit it can be used to supplement or even replace a direct expenditure of money for other sweets.

[1] Standards of purity for food products. U. S. Dept. Agr., Off. Sec. Cir. 19, 19 p., 1906.

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